

WHAT IS CLAIMED IS:

1. An emulsion comprising:
 - at least one wax;
 - an alkyl phenol;
 - 5 at least one surfactant;
 - polynaphthalenesulfonic acid;
 - an alkali metal hydroxide; and
 - water.
2. The emulsion of claim 1 wherein the alkali metal hydroxide is selected from the
- 10 group consisting of sodium hydroxide and potassium hydroxide.
3. The emulsion of claim 1 wherein the alkyl phenol is a $C_{24} - C_{36}$ polymerized methylene coupled alkyl phenol.
4. The emulsion of claim 3 wherein the $C_{24} - C_{36}$ polymerized methylene coupled alkyl phenol is present in an amount from about 0.5 to about 10 wt. %, based on the total
- 15 weight of the emulsion.
5. The emulsion of claim 1 wherein the surfactant is selected from the group consisting of a sorbitan ester, a polyoxyethylene sorbitan ester, and combinations thereof.
6. The emulsion of claim 5 wherein the sorbitan ester is sorbitan monostearate.
7. The emulsion of claim 6 wherein the sorbitan monostearate is present in an
- 20 amount from about 0.5 to about 5 wt. %, based on the total weight of the emulsion.
8. The emulsion of claim 5 wherein the polyoxyethylene sorbitan ester is polyoxyethylene sorbitan monostearate.
9. The emulsion of claim 8 wherein the polyoxyethylene sorbitan monostearate is present in an amount from about 0.5 to about 5 wt. %, based on the total weight of the
- 25 emulsion.
10. The emulsion of claim 1 wherein the surfactant is a combination of sorbitan monostearate and polyoxyethylene sorbitan monostearate.
11. The emulsion of claim 10 wherein the combination of sorbitan monostearate and polyoxyethylene sorbitan monostearate is present in an amount from about 0.5 to about 5
- 30 wt. %, based on the total weight of the emulsion.
12. The emulsion of claim 1 wherein a first wax has a melting point of at least 120 °F, and a second wax is a saponifiable wax.

13. The emulsion of claim 12 wherein the first wax is present in an amount from about 30 to about 45 wt. % and the second wax is present in an amount from about 3 to about 5 wt. %, based on the total weight of the emulsion.

14. The emulsion of claim 1 wherein the polynaphthalenesulfonic acid is present in an amount from about 0.25 to about 5 wt. %, based on the total weight of the emulsion.

15. The emulsion of Claim 1 further comprising a starch.

16. The emulsion of Claim 15 wherein the starch is a complexed starch comprising a starch and a complexing agent selected from the group consisting of a borate compound and a molybdenum compound.

17. The emulsion of Claim 16 wherein the starch is selected from the group consisting of unmodified starch, acid-modified starch, hydroxyethylated starch, oxidized starch, and cationic starch.

18. The emulsion of Claim 17 wherein the starch is acid-modified starch.

19. The emulsion of Claim 16 wherein the ratio of the complexing agent to the starch on a weight per weight basis is from about 1:4 to about 1:20.

20. A method for making an emulsion, comprising the steps of:

(a) heating to a temperature ranging from about 185°F to about 210°F a mixture containing at least one wax, an alkyl phenol, and at least one surfactant selected from the group consisting of a sorbitan ester and a polyoxyethylene sorbitan ester, producing a wax phase mixture;

(b) heating to a temperature ranging from about 185°F to about 210°F a mixture containing polynaphthalenesulfonic acid, an alkali metal hydroxide, and water, producing a water phase mixture;

(c) adding the water phase mixture to the wax phase mixture to provide a mixture;

(d) homogenizing the mixture of step (c) at a pressure from about 2000 psig. to about 4000 psig.; and

(e) cooling the homogenized mixture at a rate effective to control the stability and viscosity of the homogenized mixture.

21. The method of claim 20 wherein the alkali metal hydroxide is selected from the group consisting of sodium hydroxide and potassium hydroxide.

22. The method of claim 20 wherein the alkyl phenol is a C₂₄ – C₃₆ polymerized methylene coupled alkyl phenol.

23. The method of claim 20 wherein the surfactant is a combination of sorbitan monostearate and polyoxyethylene sorbitan monostearate.

24. The method of claim 20 wherein a first wax has a melting point of at least 120 °F, and a second wax is a saponifiable wax.

25. The method of Claim 20 wherein a complexed starch, comprising a starch and a complexing agent selected from the group consisting of a borate compound and a molybdenum compound, is added to the water phase mixture.

26. An emulsion comprising:

a first wax having a melting point of at least 120 °F in an amount of about 30 wt. % to about 45 wt. % by weight, based on the total weight of the emulsion;

a saponifiable wax in an amount from about 3 to about 5 wt. %, based on the total weight of the emulsion;

a combination of surfactants in an amount from about 0.5 to about 5 wt. %, based on the total weight of the emulsion;

an alkyl phenol in an amount from about 0.5 to about 10 wt. %, based on the total weight of the emulsion;

a polynaphthalenesulfonic acid in an amount from about 0.25% to about 5 wt. %, based on the total weight of the emulsion;

water in an amount from about 45 to about 65 wt. %, based on the total weight of the emulsion; and

an alkali metal hydroxide in an amount from about 0.5% to about 3 wt. %, based on the total weight of the emulsion.

27. The emulsion of Claim 26 further comprising a complexed starch, the complexed starch comprising a starch and a complexing agent selected from the group consisting of a borate compound and a molybdenum compound.

28. A method for making a gypsum wood fiber article, comprising the steps of:

(a) mixing a slurry containing from about 5 wt. % to about 50 wt. % of a wood fiber, from about 5 wt. % to about 50 wt. % of gypsum, from about 1 wt. % to about 3 wt. % of the emulsion of claim 27, based on the total weight of the slurry and water;

(b) distributing the slurry onto a vacuum wire for formation of a mat;

(c) partially drying the mat of step (b);

(d) compressing the mat of step (c) through a series of vacuum belt rolls; and

(e) drying the compressed mat of step (d) in an oven.

29. The method of Claim 28 wherein the wax emulsion comprises:

a first wax having a melting point of at least 120 °F in an amount of about 30 to about 45 wt. %, based on the total weight of the emulsion;

5 a saponifiable wax in an amount from about 3 to about 5 wt. %, based on the total weight of the emulsion;

a combination of surfactants in an amount from about 0.5 to about 5 wt. %, based on the total weight of the emulsion;

an alkyl phenol in an amount from about 5% to about 10% wt. %, based on the total weight of the emulsion;

10 a polynaphthalenesulfonic acid in an amount from about 0.25% to about 5% wt. %, based on the total weight of the emulsion;

water in an amount from about 45 to about 65 wt.%, based on the total weight of the emulsion; and

15 an alkali metal hydroxide in an amount from about 0.5% to about 3wt. %, based on the total weight of the emulsion.

30. The method of Claim 29 wherein the wax emulsion further comprises a complexed starch, the complexed starch comprising a starch and a complexing agent selected from the group consisting of a borate compound and a molybdenum compound.

31. A wallboard made by the method of Claim 28.

20 32. A wallboard made by the method of Claim 29.

33. A wallboard made by the method of Claim 30.

34. A sheathing made by the method of Claim 28.

35. A sheathing made by the method of Claim 29.

36. A sheathing made by the method of Claim 30.

25 37. A gypsum wood fiber article, comprising:

(a) a wood fiber;

(b) gypsum; and

(c) a wax emulsion.

38. The gypsum wood fiber article of Claim 37, wherein the wax emulsion comprises:
a first wax having a melting point of at least 120 °F in an amount of about 30% to about 45% by weight, based on the total weight of the emulsion;

a saponifiable wax in an amount from about 3% to about 5% by weight,
5 based on the total weight of the emulsion;

a combination of surfactants in an amount from about 0.5% to about 5% by weight, based on the total weight of the emulsion;

an alkyl phenol in an amount from about 0.5% to about 10% by weight, based on the total weight of the emulsion;

10 a polynaphthalenesulfonic acid in an amount from about 0.25% to about 5% by weight, based on the total weight of the emulsion;

water in an amount from about 45% to about 65% by weight, based on the total weight of the emulsion; and

an alkali metal hydroxide in an amount from about 0.5% to about 3% by weight, based on the total weight of the emulsion.
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39. The gypsum wood fiber article of Claim 38, wherein the wax emulsion further comprises a starch.

40. The gypsum wood fiber article of Claim 38, wherein the wax emulsion further comprises a complexed starch, the complexed starch comprising a starch and a
20 complexing agent selected from the group consisting of a borate compound and a molybdenum compound.

41. The gypsum wood fiber article of Claim 37, wherein the wood fiber is selected from hardwood and softwood sources, and mixtures thereof.

42. The gypsum wood fiber article of Claim 38, wherein the wood fiber is selected
25 from hardwood and softwood sources, and mixtures thereof.

43. A gypsum wood fiber article, comprising:

(a) a wood fiber;

(b) gypsum; and

(c) a wax emulsion, the wax emulsion a complexed starch, the complexed starch
30 comprising a starch and a complexing agent selected from the group consisting of a borate compound and a molybdenum compound.

44. The gypsum wood fiber article of Claim 43, wherein the wood fiber is selected from hardwood and softwood sources, and mixtures thereof.